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NOTES ON GEOGRAPHIC DISTRIBUTION

First record of the pistachio psyllid *Agonoscena cisti* (Puton, 1882) (Hemiptera, Psylloidea) in the Maltese Islands (Central Mediterranean)

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Abstract. *Agonoscena cisti* (Puton, 1882) (Psylloidea, Aphalaridae) is reported for the first time from the Maltese Islands. The species is oligophagous on pistachio plants (*Pistacia* L.) and is restricted to the Mediterranean area. Until now, only *Agonoscena targionii* (Lichtenstein, 1874) had been known from the Maltese archipelago, although the presence of *A. cisti* was predicted.

Key words. Jumping plant louse, Maltese archipelago, new record, *Pistacia* spp.

Pramatarova M, Mifsud D, Gjonov I (2024) First record of the pistachio psyllid *Agonoscena cisti* (Puton, 1882) (Hemiptera, Psylloidea) in the Maltese Islands (Central Mediterranean). Check List 20 (4): 991–995. https://doi.org/10.15560/20.4.991

INTRODUCTION

Jumping plant lice or psyllids (Hemiptera, Psylloidea) are small, narrowly host-specific insects that feed on plant phloem. Because of the damage some species inflict by their feeding, some species are considered agricultural pests as they are vectors of bacterial and phytoplasma plant diseases that cause considerable economic losses (Burckhardt 1994; Moreno et al. 2021). The superfamily comprises some 4,000 described species worldwide, although there are at least as many undescribed species (Burckhardt et al. 2021). In Europe, Psylloidea is represented by six of the seven currently recognized psyllid families (Aphalaridae, Carsidaridae, Calophyidae, Liviidae, Psyllidae, and Triozidae) with approximately 400 species (Ouvrard 2024). In Maltese Islands, 21 have been reported so far (Mifsud 2020) including a single *Agonoscena* species.

The genus *Agonoscena* Enderlein, 1914 (Aphalaridae, Rhinocolinae) currently comprises 16 extant species distributed in the Palaearctic and Afrotropical regions (Burckhardt and Lauterer 1989; Li 2011; Malenovský et al. 2012; Bastin et al. 2023). Of these, six species feed on *Pistacia* spp., while those that feed on *Pistacia vera* L. can cause significant damage in the main agricultural regions where it is cultivated, such as Iran (Mehrnejad 2020). Moreover, *Agonoscena pistaciae* Burckhardt & Lauterer, 1989 was recently reported from Spain, which was the first record of this species outside its native range (south-eastern Europe) (Rodrigo-Gómez and Burckhardt 2023). Although the taxonomy of Western Palaearctic *Agonoscena* is well studied (Burckhardt and Lauterer 1989), their small size and morphological similarity, as well as seasonal dimorphism, makes species identification somewhat difficult for non-specialists (Mehrnejad and Copland 2005; Lashkari et al. 2019).

So far, *A. targionii* (Lichtenstein, 1874) has been the only pistachio feeding psyllid known from the Maltese Islands. The aim of the present work is to provide additional data on *Agonoscena* species and their distribution in the Maltese archipelago.

METHODS

Jumping plant-lice were collected by sweeping on *Pistacia lentiscus* L. (Anacardiaceae) (Figures 1, 2). All specimens are deposited in the Zoological Collection of the Sofia University (BFUS), Bulgaria. Several specimens were slide-mounted, whereas the majority were dry-mounted. Databasing of the specimens was performed using the Specify collection management platform (https://www.specifysoftware.org/),

OPEN ACCESS

Academic editor: Shalva Barjadze
Received: 16 May 2024
Accepted: 18 July 2024
Published: 15 August 2024

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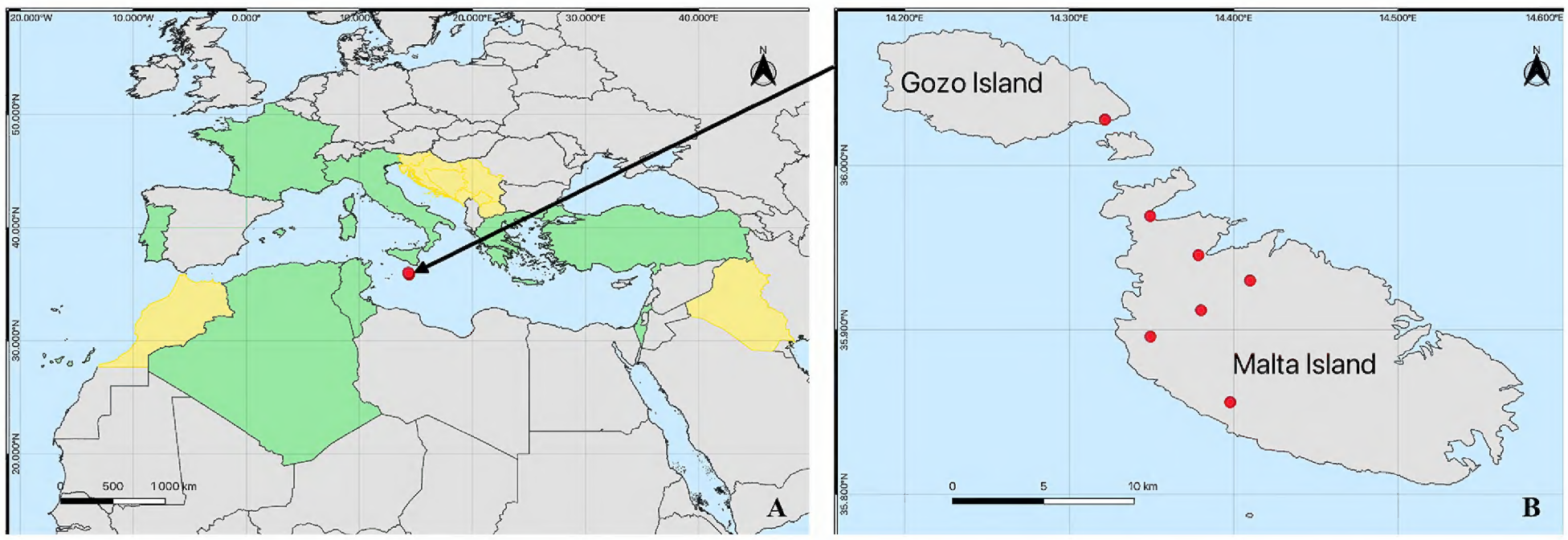

Figure 1. Distribution of *Agonoscena cisti*. **A.** General distribution, green – present, yellow – doubtful records or missing country data, grey – not present. Saint Elena Island is not shown on the map due to its remote location. **B.** Distribution in the Maltese Islands, red dot – localities where species was found in the present study.

Figure 2. Habitat of *Agonoscena cisti* in Binġemma.

where all metadata were uploaded in the database of BFUS, receiving an unique identifier and machine readable QR-code. Specimens were photographed using a Canon 70D DSLR camera with a Canon MP-E 65 mm macro lens and a Yongnuo YN-24EX macro flash. The distribution map (Fig. 1) was created using QGIS v. 3.6.0 (http://www.qgis.org) and Database of Global Administrative Areas (GADM) shapefile (http://www.gadm.org).

RESULTS

Aphalaridae Löw, 1879
Rhinocolinae Vondráček, 1957
Agonoscena Enderlein, 1914

***Agonoscena cisti* (Puton, 1882)**
Figure 3A, B

New records (material examined). MALTA – Malta Island • Għadira Nat Park; 35.969°N, 014.349°E; 10 m a.s.l.; 08.VI.2019; Ilia Gjonov leg.; IG43/19; 6 ♂, BFUS-I-IG028208 – BFUS-I-IG028213, 7 ♀, BFUS-I-IG028214–BFUS-I-IG028220 • Buskett Gardens; 35.856°N, 014.398°E; 200 m a.s.l.; 17.IV.2024, Ilia Gjonov

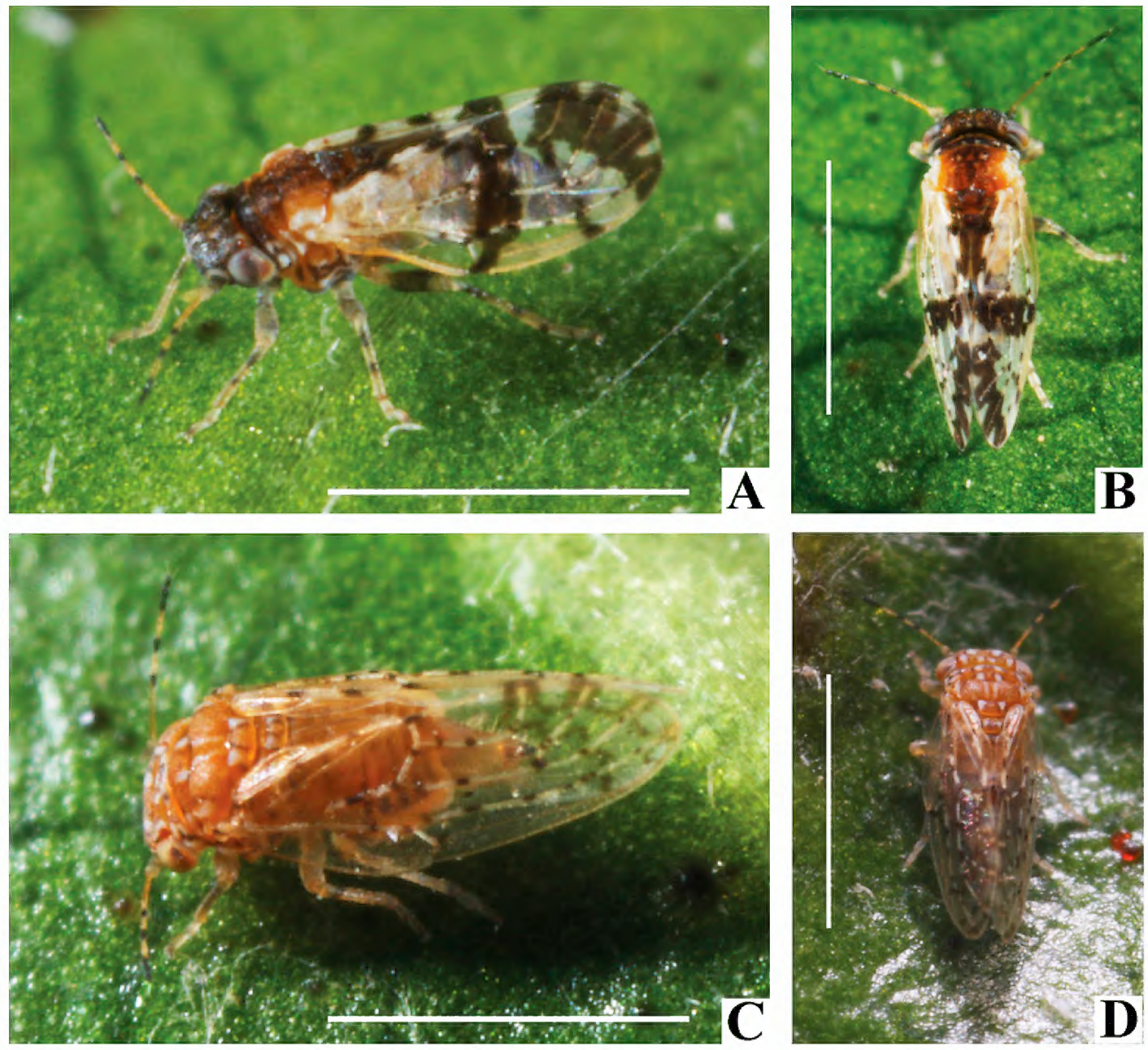

Figure 3. Adults of Maltese *Agonoscena* spp. **A.** *A. cisti*, lateral view. **B.** *A. cisti*, dorsal view. **C.** *A. targionii*, lateral view. **D.** *A. targionii*, dorsal view. Scale bar: 1 mm.

leg.; IG15/24; 23 ♂, BFUS-I-IG028221–BFUS-I-IG028243, 8 ♀, BFUS-I-IG028244 – BFUS-I-IG028251 • Binġemma; 35.912°N, 014.380°E; 90 m a.s.l. (Figure 2); 18.IV.2024; Ilia Gjonov leg.; IG16/24; 2 ♀, BFUS-I-IG028252–BFUS-I-IG028253 • Il-Baħrija; 35.896°N, 014.349°E, 210 m a.s.l.; 18.IV.2024; Ilia Gjonov leg.; IG18/24; 13 ♂, BFUS-I-IG028254 – BFUS-I-IG028266, 23 ♀, BFUS-I-IG028267–BFUS-I-IG028289 • Salina; 35.930°N, 014.410°E; 50 m a.s.l.; 19.IV.2024; Ilia Gjonov leg.; IG20/24; 6 ♂, BFUS-I-IG028290 – BFUS-I-IG028295, 5♀, BFUS-I-IG028296–BFUS-I-IG028300 • Wardija; 35.946°N, 014.379°E, 0 m a.s.l., 19.IV.2024; Ilia Gjonov leg.; IG21/24; 2 ♀, BFUS-I-IG028301–BFUS-I-IG028302 – Gozo Island • Hondoq Bay; 36.028°N, 014.322°E; 10 m a.s.l.; 20.IV.2024; Ilia Gjonov leg.; IG22/24; 3 ♂, BFUS-I-IG028303–BFUS-I-IG028305, 6 ♀, BFUS-I-IG028306–BFUS-I-IG028311.

Identification. Adults of *Agonoscena cisti* (Figure 3A, B) can be reliably distinguished from *A. targionii* (Lichtenstein, 1874) (Figure 3C, D) (already known from Malta) based on morphological characteristics outlined by Burckhardt and Lauterer (1989) and Rodrigo-Gómez and Burckhardt (2023): a predominantly dark-brown, almost black body with pale yellow legs, bearing dark-brown femoral spot; a concave C+Sc vein; forewings with a distinctive broad band pattern along the outer margin; raised tubercular meracathus on the metacoxae; very small posterior process of parameres, situated subapically; female proctiger forming an apical process, as it is dorsally concave. Additionally, specimens of *A. cisti* were compared with specimens of *A. pistaciae* deposited in BFUS.

DISCUSSION

Agonoscena cisti develops on *Pistacia lentiscus* L. (Hodkinson and Hollis 1981; Burckhardt 1989; the former is confirmed by the presence of immatures) and *P. palaestina* Boiss. (Halperin et al. 1982; Burckhardt 1989). The species was described from France by Puton (1882) and has since been reported within the Palaearctic Region, mostly restricted to the Mediterranean Basin. In the past, *A. cisti* has often been misidentified. Therefore, we consider only the records after Hodkinson and Hollis (1981) defined the species to be reliable: Algeria (Burckhardt 1989), the Balearic Islands and Canary Islands (Spain) (Hodkinson and Hollis 1981), Greece (Burckhardt 1987), Italy (Burckhardt and Lauterer 1989), Israel (Halperin et al. 1982), Portugal (Burckhardt and Lauterer 1989), Saint Helena (Great Britain) (Burckhardt and Lauterer 1989), Tunisia (Burckhardt and Lauterer 1989), Turkey (Lodos and Önuçar 1985), and the former Yugoslavia (Burckhardt and Lauterer 1989). Although *A. targionii* has been the only species from genus *Agonoscena* recorded from the Maltese

Islands (Mifsud 2020), *A. cisti* was included in the dichotomous key by Mifsud (1997) as a species that could potentially occur in Malta. The presence of *A. cisti* in Malta is not surprising considering that both *A. cisti* and *A. targionii* have a similar Mediterranean distribution, so we consider *A. cisti* to be native to the Maltese Islands. We found both *A. cisti* and *A. targionii* in mixed populations across all surveyed localities in Malta, some of them visited by Mifsud in 1994 (Mifsud 1997, 2020); however, it is very likely that no specimens of *A. cisti* have been collected in the past as the species is less abundant than the related *A. targionii*. The new discovery of *A. cisti* for the Maltese entomofauna is noteworthy as it further increases the knowledge of the distribution range of the species. Furthermore, considering that four (*Acizzia uncatoides* (Ferris & Klyver, 1932, *Blastopsylla occidentalis* Taylor, 1985, *Glycaspis brimblecombei* Moore, 1964, and *Macrohomotoma gladiata* Kuwayama, 1908) of the 21 species reported by Mifsud (2020) are introduced taxa, this finding is even more valuable and highlights the need for further studies to better understand the biodiversity of the Maltese archipelago and its conservation.

ACKNOWLEDGEMENTS

We are grateful to the reviewers for their constructive feedback and valuable suggestions, which greatly improved the paper.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding

This study was financially supported by Scientific Research Fund of SU “St. Kliment Ohridski”, grant number 80-10-5/2024.

Author contributions

Conceptualization: MP, DM, IG. Data curation: MP, DM, IG. Formal analysis: MP, DM, IG. Investigation: DM, IG. Methodology: IG. Resources: DM, IG. Supervision: DM, IG. Visualization: MP, IG. Writing – original draft: MP, DM, IG.

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Data availability

All data that support the findings of this study are available in the main text.

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